

Socio-demographic characteristics associated with HIV and syphilis seroreactivity among pregnant women in Blantyre, Malawi, 2000-2004

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Abstract

Objectives: We aimed to evaluate socio-demographic factors associated with HIV and syphilis seroreactivity in pregnant Malawians presenting for antenatal care in late third trimester of pregnancy.

Methods: Between December 2000 and March 2004 at Queen Elizabeth Central Hospital Blantyre, Malawi, we collected cross-sectional clinical and socioeconomic data from consenting women. HIV-1 status was determined using rapid HIV antibody tests and syphilis seroreactivity was determined using Rapid Plasma Reagin (RPR) and confirmed with Treponema pallidum hemagglutination assay (TPHA).

Results: Of 3,824 women screened for HIV, 1156 (30%) were HIV seropositive and 198 (5%) were RPR and TPHA seroreactive. In the multivariate analysis, HIV infection was positively associated with elevated socio-economic status, being formerly married, and age, but not with education level. HIV prevalence was lower in women of Yao ethnicity than in other women (OR: 0.78, 95%CI: 0.64 - 0.95). Increased maternal education was negatively associated with syphilis seroreactivity.

Conclusions: The seroprevalence of HIV and syphilis among women attending the antenatal ward in Blantyre remains unacceptably high. Demographic correlates of HIV and syphilis infections were different. Our results demonstrate the need for better strategies to prevent HIV and syphilis in women and calls for optimizing antenatal syphilis screening and treatment in Malawi.

Introduction

Two thirds of all HIV/AIDS infected persons and 75% of all HIV infected women live in Sub-Saharan Africa (SSA). Malawi, one of the countries in SSA most affected by HIV, reported a national HIV prevalence of 20% among pregnant women in 2003¹. In addition to the prevalent HIV infections, in 2003, approximately 3% of pregnant Malawian women were also infected with syphilis¹. Syphilis is an important cause of maternal morbidity, still births, low birth weight and congenital malformations^{2,4}. We have recently shown that maternal syphilis increases the risk of mother to child

HIV transmission⁵.

Relatively few people in SSA have access to HIV and syphilis control measures. A survey of 22 sub-Saharan countries showed that on average, only 38% of women who attended ANC were screened for syphilis⁶; more recently, a community-based survey in Western Kenya revealed that only 19% of women attending ANC were tested for syphilis⁷. Because of significant health system constraints in Malawi, coverage of HIV and syphilis interventions is expected to remain low in the short-medium term⁸. In Malawi in 2005, it was estimated that only 3 % of HIV-infected pregnant women received nevirapine to reduce HIV mother-to-child transmission⁸. In order to better understand the epidemiology of HIV and syphilis among pregnant women in Malawi, we assessed the socio-demographic correlates of these two infections at an antenatal ward in Blantyre, Malawi.

Methods

Setting

Women seeking care at the Queen Elizabeth Central Hospital (QECH) antenatal ward (ANW) in Blantyre, Malawi, from December 2000 until March 2004 were evaluated. QECH is the main tertiary referral hospital in southern Malawi and also functions as the district hospital for Blantyre; it handles approximately 15,000 deliveries per year. In general, pregnant women in Malawi attend prenatal care 16 to 20 weeks into the pregnancy, soon after quickening begins (fetal kicking).

Study recruitment

Women admitted to the ANW were screened and if eligible and consenting, enrolled in a study on malaria and mother to child transmission of HIV. The study had two goals, 1) to document the socio-demographic features associated with HIV infection in pregnant women, and 2) to investigate the effects of placental malaria on HIV mother-to-child transmission. Enrollment details and the results from the longitudinal cohort study of the HIV-infected women have been described⁵. Although documenting syphilis cases was not a stated goal of the study, in accordance with the Malawi Standard Treatment Guide, participants were tested serologically for syphilis as described below. Owing to logistical constraints and the short time period between enrollment and delivery (median 4.5 days), syphilis testing was done in batches, and as a result, many of the syphilis-seroreactive women and their children were treated with benzathine penicillin postnatally.

A standard questionnaire was used to collect socio-demographic data. Marital status was categorized as single, married, or formerly married (separated or divorced or widowed). The cost of materials used in the construction of the primary residence was considered a surrogate of

socio-economic status, with mud and pole construction representing the least expensive materials, brick walls with a grass-thatched roof representing a moderate expense, and brick walls with iron sheets representing the most expensive materials. For married women, their husband's occupation was categorized into 21 informal categories according to the perceived similarity of the level of training required for that career. Additionally, the women were asked if they had ever been diagnosed with HIV, a sexually transmitted infection (STI), or tuberculosis (TB). Previous STIs, except HIV and syphilis, and TB infection, were not verified by medical tests or medical records.

Laboratory tests

HIV status was determined simultaneously with the Determine™ HIV-1/2 Rapid Antibody Test (Abbott Laboratories, IL, USA) and the SeroCard™ HIV-1/2 Rapid Test (Trinity Biotech Plc, Co Wicklow, Ireland); discordant results were resolved with the HIVSPOT HIV-1/2 Rapid Test (Genelabs Diagnostics, Singapore). Women were tested for syphilis using the Rapid Plasma Reagin test (RPR), Omega Diagnostics, Alloa, Scotland), and all RPR reactive sera were tested with the Treponema pallidum Hemagglutination Assay (TPHA), Omega Diagnostics, Alloa, Scotland). Clinical signs of syphilis or recent treatment were not evaluated, and women with a reactive RPR followed by a reactive TPHA were considered syphilis seroreactive. Hemoglobin concentration was measured using a hemoglobinometer (HemoCue AB, Ängelholm Sweden), with anemia defined as a hemoglobin concentration less than 11 g/dL. Peripheral malaria infection was assessed on thick blood films stained with Field's stain.

Statistical methods

Data were entered into Microsoft Access in duplicate, cross-checked, and analyzed with Stata v8.2 (StataCorp, College Station, TX, USA). The association between nominal categorical variables and infection was evaluated with the chi-squared test for independence; monotonic trends in ordinal categorical variables were tested with a chi-squared statistic for trend ("ptrend" module, Stata). Previous studies have suggested an inverse association between HIV status and Islamic faith, and therefore we decided a priori to test the association between HIV and belonging to the Yao tribe, the predominant Muslim tribe in Malawi. Prevalence odds ratios (ORs) of binary variables associated with HIV and syphilis infection were calculated from contingency tables and tested with a chi-squared statistic or Fisher's exact test. In order to determine the independent correlates of HIV and syphilis seroreactivity, demographic features associated with either HIV or syphilis in the univariate analysis ($p < 0.1$) were included in a multivariable model.

Ethical considerations

The study was approved by the Malawi College of Medicine Research and Ethics Committee and by the Institutional Review Boards at both the University of Michigan and the University of North Carolina at Chapel Hill. Informed consent was received from all participants.

Results

Participant characteristics

Of the 6184 women invited to participate in this study, 3,824 (62%) were enrolled. Over the course of the study, the acceptance rate declined, with 881 out of 1257 (70%)

enrolled the first year, 1389 out of 2080 (67%) enrolled the second year, 1201 out of 2137 (56%) enrolled the third year, and 353 out of 700 (50%) enrolled in the fourth year. No additional information was ascertained from the women who declined to participate. HIV prevalence was 27.9% in 2001, 29.4% in 2002, 32.5% in 2003, and 32.7% in 2004; syphilis seroreactivity by year was 7.3%, 4.6%, 4.2%, and 5.7% respectively.

Table 1 outlines the demographic characteristics of the participants. Overall, peripheral *P. falciparum* parasites were detected in 9% of the women, 2% percent of the women reported being previously diagnosed with HIV, 5% with a STI, and 3% with TB. When asked, 22% of the women reported fever during the week preceding enrollment, 32% general body pains and 42% headache. The mean hemoglobin concentration was 11.1 g/dL (SD = 1.9).

Factors associated with HIV seroreactivity

Thirty percent of the 3,824 women were HIV positive, with the highest HIV prevalence among women aged 26-30 (Table 1). Women with HIV infection more often reported previous diagnoses of TB, STI or HIV, as well as fever the previous week (data not shown). HIV-infected women were also more likely to have anemia (OR: 2.5, 95%CI: 2.1, 2.9), *P. falciparum* peripheral parasitemia (OR: 1.3, 95%CI: 0.99, 1.6), and syphilis (Table 1). HIV prevalence varied by gravidity, marital status, and the location of their primary residence; the highest prevalence was observed among multigravid, formerly-married, and urban women. Women who self-identified as Yao had a significantly lower HIV prevalence than the women of all other ethnicities combined (26% versus 31%, OR: 0.78, 95% CI: 0.64, 0.95).

HIV prevalence was similar among all education strata, but women who were formally employed had a higher HIV prevalence compared to those who were unemployed, and women with the most expensive houses had a higher HIV prevalence than those in less expensive housing (Table 1).

Married women, who represent 91% of the study population, were stratified into 21 groups according to their husband's occupation. HIV prevalence varied significantly by their husband's occupation, ranging from 20% (married to a farmer) to 28% (married to a non-skilled laborer) to 45% (married to a driver) ($\chi^2=65$; $df=20$, $p<0.001$).

Factors associated with Syphilis seroreactivity

Of 3,805 women screened, 285 (8%) were RPR reactive. Of 270 RPR reactive sera tested, 198 (73%) were TPHA reactive, resulting in an overall 5% syphilis seroreactivity. There was no association between syphilis seroreactivity and peripheral malaria (OR: 0.76, 95% CI 0.40, 1.3). Four (2%) of the women with- and 44 (1%) of the women without syphilis seroreactivity reported taking antibiotics in the two weeks prior to enrollment. Syphilis seroreactivity was 8 % among HIV positive women and 4 % among HIV negative women (OR: 2.1, 95%CI: 1.5, 2.8). Of the 195 syphilis seroreactive women with data on ANC attendance, 194 had attended the ANC at least once (median= 4, range 0, 11). Syphilis seroreactivity was associated with anemia (OR: 1.4, 95% CI 1.0, 1.9), previous diagnosis of STI (OR: 5.3, 95%CI: 3.5, 8.0), as well as rural residence, and multigravidity (Table 1) and was not associated with self-reported TB, HIV diagnosis, or fever in the week preceding enrollment (results

Table 1 Socio-demographic characteristics associated with HIV or Syphilis seroreactivity

	Enrollment (N=3824)	HIV-infected (N=3824)	Syphilis Seroreactive (N=3790)		
	n (%)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Overall		1156 (30)		198 (5)	
Age (in years)					
median (range)*	22 (14-51)				
<20	985 (26)	159 (16)	1.	35 (4)	1.
20-25	1,605 (42)	540 (34)	2.6 (2.2, 3.2)	108 (7)	2.0 (1.3, 2.9)
26-30	603 (16)	257 (43)	3.9 (3.0, 4.9)	35 (6)	1.7 (1.0, 2.7)
31-35	283 (7)	110 (39)	3.3 (2.4, 4.5)	11 (4)	1.1 (0.56, 2.2)
>35	156 (4)	34 (22)	1.4 (1.0, 2.2)	4 (3)	0.72 (0.25, 2.1)
missing	192 (5)		$\chi^2 = 160, p < 0.0001$		$\chi^2 = 16, p = 0.003$
Employment					
not working	3023 (79)	865 (29)	1.	156 (2)	1.
formally-employed	715 (19)	260 (36)	1.4 (1.2, 1.7)	39 (6)	1.1 (0.74, 1.5)
missing	86 (2)		$\chi^2 = 17, p < 0.0001$		$\chi^2 = 0.13, p = 0.7$
Completed Level of Education					
none	357 (9)	111 (31)	1.	25 (7)	1.
4 years primary	769 (20)	257 (33)	1.1 (0.9, 1.5)	54 (7)	1.0 (0.61, 1.6)
8 years primary	1540 (40)	445 (29)	0.90 (0.70, 1.2)	83 (5)	0.76 (0.48, 1.2)
2 years secondary	528 (14)	158 (30)	0.95 (0.71, 1.3)	18 (3)	0.47 (0.25, 0.87)
4 years secondary	610 (16)	183 (30)	0.95 (0.72, 0.26)	17 (3)	0.38 (0.20, 0.71)
missing	20 (1)		$\chi^2_{(trend)} = 1.2, p = 0.3$		$\chi^2_{(trend)} = 17, p < 0.0001$
Cost of Housing Material					
high	2639 (69)	854 (32)	1.	133 (5)	1.
medium	1057 (28)	266 (25)	0.70 (0.60, 0.83)	61 (6)	1.2 (0.85, 1.6)
low	104 (3)	24 (23)	0.63 (0.39, 1.0)	4 (4)	0.75 (0.27, 2.1)
missing	24 (1)		$\chi^2_{(trend)} = 20, p < 0.001$		$\chi^2_{(trend)} = 0.20, p = 0.7$
Gravidity					
1	1401 (37)	269 (19)	1.	44 (3)	1.
2-4	1860 (49)	714 (38)	2.6 (2.2, 3.1)	119 (7)	2.1 (1.5, 3.0)
>4	562 (15)	173 (31)	1.9 (1.5, 2.3)	35 (6)	2.1 (1.3, 3.3)
missing	1 (0)		$\chi^2 = 140, p < 0.0001$		$\chi^2 = 19, p = 0.0001$
Marital Status					
married	260 (7)	1044 (30)	1.	180 (5)	1.
single	3468 (91)	60 (23)	0.69 (0.51, 0.94)	12 (5)	0.87 (0.48, 1.6)
formerly married	84 (2)	49 (58)	3.3 (2.1, 5.1)	6 (7)	1.4 (0.60, 3.2)
missing	13 (0)		$\chi^2 = 38, p < 0.001$		$\chi^2 = 0.82, p = 0.7$
Residence					
urban	2720 (71)	856 (32)	1.	131 (5)	1.
periurban	509 (13)	148 (29)	0.89 (0.72, 1.1)	28 (6)	1.1 (0.75, 1.7)
rural	518 (14)	132 (25)	0.74 (0.60, 0.92)	35 (7)	1.4 (0.98, 2.1)
outside Blantyre	49 (1)	11 (22)	0.63 (0.32, 1.2)	3 (6)	1.3 (0.39, 4.2)
missing	29 (1)		$\chi^2 = 9.3, p = 0.03$		$\chi^2 = 3.6, p = 0.3$

Row percentages equal the % HIV or syphilis positive per strata. Statistics presented do not include missing data.

*One woman reported being 15 years old, but was later found to be 14 years old.

Table 2 Multivariable regression of sociodemographic factors independently associated with HIV infection or Syphilis seroreactivity

	HIV infection	Syphilis infection
Variable	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Age (in years)		
<20	1.	1.
20-25	2.0 (1.6, 2.6)	1.4 (0.83, 2.1)
26-30	2.9 (2.2, 4.0)	0.74 (0.39, 1.4)
31-35	2.7 (1.8, 4.0)	0.39 (0.16, 0.96)
>35	1.5 (0.91, 2.6)	0.17 (0.05, 0.65)
Completed Level of Education		
none	1.	1.
4 years primary	1.2 (0.91, 1.7)	0.92 (0.55, 1.5)
8 years primary	1.0 (0.78, 1.4)	0.68 (0.42, 1.1)
2 years secondary	1.1 (0.81, 1.6)	0.44 (0.22, 0.86)
4 years secondary	1.1 (0.75, 1.5)	0.35 (0.17, 0.71)
Cost of Housing Material		
high	1.	1.
medium	0.74 (0.61, 0.90)	0.87 (0.60, 1.3)
low	0.78 (0.46, 1.3)	0.47 (0.14, 1.6)
Formal Employment	1.2 (1.0, 1.5)	1.2 (0.78, 1.7)
Gravidity		
1	1.	1.
2-4	1.7 (1.4, 2.1)	2.0 (1.2, 3.1)
>4	1.1 (0.77, 1.6)	3.1 (1.5, 6.2)
Marital Status		
married	1.	1.
single	0.80 (0.58, 1.2)	0.73 (0.36, 1.5)
formerly married	3.1 (1.7, 5.7)	0.85 (0.27, 2.7)
Member of Yao Tribe		
no	1.	1.
yes	0.75 (0.61, 0.92)	0.87 (0.58, 1.3)
Residence		
urban	1.	1.
semi-urban	0.86 (0.68, 1.1)	1.2 (0.74, 1.8)
rural	0.81 (0.63, 1.0)	1.3 (0.82, 2.1)

not shown). Syphilis seroreactivity was associated with a self-reported history of miscarriage or stillbirth (OR: 2.3, 95%CI: 1.6, 3.5) and was most common among multigravid women in their early twenties (Table 2). Syphilis was not associated with maternal employment, cost of housing material, being a Yao, or marital status. Syphilis seroreactivity was inversely associated with maternal education ($\chi^2_{\text{(trend)}}=17$, $p<0.0001$).

Factors associated with dual HIV and Syphilis seroreactivity

Ninety-two (2.4%) of the participants were seroreactive for both HIV and syphilis. Dual infection was most prevalent among 20-25 year olds (3.6%), and dual infection, like syphilis seropositivity, was inversely associated with education level. Dual infection was not associated with formal employment,

residence, cost of housing material, or being a member of the Yao tribe. However, due to the small number of dually-infected women, these results should be interpreted with caution.

Factors associated with HIV versus Syphilis seroreactivity in multivariate analyses

Table 2 shows the demographic variables that were independently associated with HIV and syphilis seroreactivity. HIV infection was independently associated with age 20 years or older, formal employment, gravidity between 2-4, high cost of housing materials, and former marriage, and it was inversely associated with Yao identity. Syphilis seroreactivity was independently associated with multigravidity and inversely associated with both age and education level.

Discussion

Among women who attended a tertiary-care hospital in urban Malawi in late pregnancy, HIV infection was positively associated with formerly being married, and multigravidity, but was not associated with the level of maternal education. Syphilis infection was independently and positively associated with multigravidity and was highest among women with the least schooling. We also observed a difference in the age distributions of syphilis seroreactivity (decreasing with age) and HIV (peaking at 26-30 years).

Data from Tanzania estimate that antenatal syphilis screening is still cost-effective in sub-Saharan Africa. Based on the 8% RPR reactivity among ANW attendees in our study, the cost per disability adjusted life year averted by screening for syphilis (including stillbirths) at QECH would be about US\$10⁹. In addition to the morbidity associated with adult syphilis infections, children born to syphilis infected mothers have higher morbidity rates¹⁰, and increased odds of stillbirth, neonatal death, and post-neonatal death¹¹. Syphilis is a significant risk factor for HIV subtype C mother to child transmission⁵, which suggests that treatment of maternal syphilis could also reduce pediatric HIV infections.

Antenatal care policy in Malawi states that all pregnant women should be screened for syphilis, and if RPR seroreactive, treated with benzathine penicillin. In our setting, syphilis seroreactive participants attended the ANC on average four times prior to study enrollment, which should have provided ample opportunity for syphilis screening and treatment early in pregnancy. Why the women were not previously tested for syphilis was not addressed by this study, nor was the possibility that the women were previously tested and treated. In order to promote optimal antenatal syphilis screening and treatment in Malawi, current routine practices and obstacles should be evaluated to minimize missed opportunities.

Previous studies in sub-Saharan Africa assessing the relationship between HIV and education level have produced conflicting results^{12, 13}. Two studies in Malawi, the 2003 Malawi NAC report and one by Taha and colleagues in 1998¹⁴, reported a decrease in HIV prevalence as the level of education increased; in contrast, our study found no such association. To rule out different definitions of education level, we stratified our education data into the 3 categories reported by Taha and colleagues, and still failed to observe an association between education and HIV status ($p=0.9$).

We are unable to conclude whether our results reflect an HIV epidemic that increasingly affects the more educated layers of society or whether the different observations might be a result of differences in sampling design or reflect variations in local HIV transmission dynamics.

In contrast to HIV, and consistent with other reports¹⁵⁻¹⁷, an increase in maternal education was independently associated with a decrease in syphilis seroreactivity. While the data presented here do not allow us to assess the underlying cause of this association, this finding should encourage the design of specific strategies and health education messages to curb syphilis and HIV-infection among women who attend the antenatal ward.

It has been reported elsewhere in sub-Saharan Africa that Muslims have lower HIV prevalence than non-Muslims¹⁸. According to the 2000 Malawi Demographic and Health Survey, 4% of non-Yao Malawians were Muslim while 75% of the Yao were Muslim (H. Misiri, unpublished observation). Because of their religious beliefs and according to anecdotal observations, it is likely that the Yao are more likely to routinely circumcise men than other tribes in Malawi. Male circumcision has recently been shown to protect men from incident HIV¹⁹⁻²¹, and it is therefore plausible to speculate that the lower prevalence among the Yao women is due to lower HIV prevalence among their circumcised partners²². However, because our questionnaire did not ascertain the partner's religion, the prevalence of partner circumcision, and other specific cultural practices, we cannot definitively determine if partner circumcision is associated with the low HIV prevalence among pregnant Yao women.

Our findings are limited by the cross-sectional nature of the data, the self-reported nature of many of the exposure variables, and our inability to accurately define active syphilis among the syphilis seroreactors. Approximately 38% of the women asked to participate in this study declined, and because there were no additional data collected on those who refused, we are unsure how well these data can be generalized to the total population of women attending the ANC at Queen Elizabeth Central Hospital. Although we used a qualitative serology-based case definition of syphilis, which may give limited information in the absence of results of recent testing and treatment, our observations are still useful. While a high proportion of RPR reactive sera (27%) were not confirmed by TPHA, the observed association between reported history of spontaneous abortion and RPR and TPHA seroreactivity gives credibility to the syphilis testing. Women found to be syphilis seroreactive represent women who should have been treated early during their pregnancy. Finally, because we enrolled women who presented to the antenatal ward at QECH, which is a tertiary care center, these results are likely not representative of the general Malawian population. Further studies assessing the socio-demographic correlates of HIV and syphilis infection in non-referral centers and in the community are warranted.

In conclusion, we report a 30% HIV prevalence and a 5% syphilis seroreactivity among pregnant women who presented to the ANW at QECH. Although there was substantial overlap between the factors associated with HIV and syphilis seroreactivity, the two infections affect slightly different populations. Several initiatives have been taken to increase antiretroviral treatment coverage among

pregnant Malawians for both HIV treatment and for MTCT prophylaxis (for example, see http://www.id.unc.edu/malawi/studies_research.htm). These programs should be complemented with improved efforts in antenatal screening and treatment of syphilis²³.

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6. The impact of HIV on mortality during in-patient rehabilitation of severely malnourished children in Malawi.

Chinkhumba J, Tomkins A, Banda T et al

Trans R Soc Trop Med Hyg. 2008;102(7):639-44.

A prospective cohort study measured mortality during nutritional rehabilitation among HIV-infected and uninfected children, aged 6-59 months, with severe acute malnutrition (SAM). The authors conclude that routine testing and treatment for HIV among all malnourished children is necessary to improve quality of care and reduce mortality among children with SAM.

7. Outcomes in HIV-infected patients who develop tuberculosis after starting antiretroviral treatment in Malawi.

Yu JK, Bong CN, Chen SC et al

Int J Tuberc Lung Dis. 2008;12(6):692-4.

A retrospective review was conducted of patients starting antiretroviral treatment (ART) at Mzuzu Central Hospital, Malawi, to identify those who developed tuberculosis (TB) within 6 months of commencing ART and document their treatment outcomes. The authors propose easier methods are needed to diagnose TB in human immunodeficiency virus-infected patients and to prevent patients from developing TB while on ART.

8. Natural history and risk factors associated with early and established HIV type 1 infection among reproductive-age women in Malawi.

Kumwenda JJ, Makanani B, Taalo F et al

Clin Infect Dis. 2008 15;46(12):1913-20.

The study examines plasma viral levels and trends during early and established HIV-1 infection among reproductive-age women who participated in a randomized trial to treat genital tract infection in Malawi. Also assessed was the association of injectable hormonal contraceptive use with HIV-1 infection. The authors conclude that knowledge of virus set point and trends of viral load in HIV-1 seroincident and seroprevalent asymptomatic women could assist in antiretroviral treatment management.

9. Causes of blindness among children identified through village key informants in Malawi.

Kalua K, Patel D, Muhit M, Courtright P

Can J Ophthalmol. 2008;43(4):425-7.

A cross sectional study of children in communities of Chikwawa district, Malawi was conducted to determine the causes of blindness among children in rural Malawi. Cataract (congenital/developmental) was the leading cause of blindness (35%), followed by corneal conditions (22%). The authors propose that this Chikwakwa is an area once noted for vitamin A deficiency in children resulting in cataract development. Priorities for early cataract detection and intervention need to be considered for restoration of sight in children.

10. Nutritional status at admission of children with cancer in Malawi.

Israëls T, Chirambo C, Caron HN, Molyneux EM

Pediatr Blood Cancer. 2008;51(5):626-8.

Arm anthropometry shows that more than half of Malawian children with cancer are severely acutely malnourished at diagnosis. Weight for height, in children with large tumour masses, is less sensitive than arm anthropometry in detecting acute malnutrition. Forty-five percent of paediatric oncology patients in Malawi are stunted, making interpretation of weight for age very difficult.